REMARKS

Applicant would like to thank the Examiner, Hwei-Sui Payer, for the personal interview which occurred on February 4, 2002 between Applicants' representative, Kristi L. Davidson, and the Examiner.

The Examiner has rejected claims 1-4, 7, 10, 12-14, 16-22 and 27-29 under 35 U.S.C. § 103(a) as being unpatentable over Baker U.S. Patent No. 3,952,179 in view of Brown et al. U.S. Patent No. 4,323,756. Claims 8, 9, 11, 15 and 24-26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Baker and Brown et al. as applied to claims 1, 10, 13 and 22 above, and further in view of Cox et al. U.S. Patent No. 5,417,132.

The Examiner's position is that Baker discloses cladding a hard blade on a cutting die, but using a different heat source. Baker deposits weld beads on the tubular die surface, and then machines the weld bead to form the blade. Applicant has previously discussed in detail the inability of welding technology to produce near net shape blades. This is confirmed by the extensive machining requirements set forth in the Baker patent in FIGS. 3-8 and the accompanying text. Brown et al. use a laser heat source, which the Examiner reasons may be substituted for the welding source in the Baker patent to thereby render obvious the presently claimed invention. Applicant respectfully traverses.

Claims 1-4, 17-20, 22 and 24 have been amended to specify that the blade material is introduced into the heated area "while heating said area." Support for the amendment, and the following remarks, may be found in the application at:

- page 10, line 17 to page 11, line 4: States that "Powder feeder 16 can be either a side feeder or coaxial feeder . . .", wherein "the powder feeder 16

is associated with the laser head 10, so as to selectively introduce powder into the area being clad . . . ."

- page 11, lines 10-15: States that "The laser beam 10 is scanned along the die surface 13A, so as to melt or 'puddle' an area 17 in the surface 13A, along a path . . ." and that "Upon such melting or puddling, the powder 16A is fed into the area being clad by the laser . . . ."
- page 16, lines 12-13: States that the invention includes a "laser which can locally melt die surface and powder."
- page 16, lines 19-21: States that "the heating source which is used to melt cladding material and die surface is not limited to lasers."
- original Claim 10, line 7: claims "introducing metal into said path while heating said path . . . ."

Claims 10 and 27 already included this feature. The specification has also been amended at page 11, line 15 to add language from original claim 10. Claim 13, which was copied verbatim from Islam et al. U.S. Patent No. 5,855,149, and claim 16, which was substantially copied from Islam et al., include the feature of "moving a laser beam along said path to heat the metal base and simultaneously supplying powdered metal having a composition distinct from said base to said predetermined path via a tube moving concurrently with said laser beam so that said laser beam melts a thin layer of the metal base along said path and also melts the metal powder being delivered to the base and thus forms a band of fused metal powder along said path." Amended claim 21 and new claim 30 specify that the powder feeder is coaxial with the laser beam.

Brown et al. discloses an apparatus and method in which the wire or powder feeder is arranged so that the powder strikes the surface outside of the laser beam. As stated in col. 3, lines 1-8, "A critical feature of this invention is the relationship of the material feed point 6 to the point of interaction 4 between the energy beam 1 and the workpiece surface 5. . . . it is desirable that the feedstock 3 contact the workpiece surface 5 outside of the energy beam 1, but very near the point 4 where the laser beam 1 intersects the workpiece surface 5." In col. 3, lines

22-43, Brown et al. state that "the material feedstock 3 touches the workpiece surface 5 upstream of the point of contact 4 between the energy beam 1 and the workpiece surface 5, and the feed material 3 is brought into the interaction zone of the energy beam and the molten pool of metal and is melted into the molten pool. If a wire feedstock enters the laser beam before it contacts the workpiece surface, it will melt and form globules, suspended from the wires, which will either fall off the feedstock and drop on to the surface or will grow on the end of the feedstock until the globules touch the workpiece surface. Either of these conditions is unsatisfactory and produces a rough, irregular deposit. . . ." Thus, Brown et al. teaches against introducing the blade material into the heated area <u>while</u> heating said area. In other words, the presently claimed invention contemplates feeding the blade material into the area of the die surface being heated by the laser at the point of contact between the laser beam and the die surface area and concurrently therewith, whereas Brown et al. contemplate feeding the material onto the die surface outside the beam, and then passing the material through the beam after the beam has already begun to create a molten pool of surface metal. By this method, the deposited feedstock is thereafter drawn into the molten pool and melted by the melted surface metal and laser beam jointly. "A prior art reference must by considered in its entirety, i.e., as a <u>whole</u>, including portions that would lead away from the claimed invention." MPEP § 2141.02 citing *W.L. Gore & Associates, Inc. v. Gurlock, Inc.*, 721 F.2d 1540, 220 U.S.P.Q. 303 (Fed. cir. 1983), *cert denied*, 469 U.S. 851 (1984). Brown et al. teaches against heating the feedstock with the laser beam before it is deposited on the surface, as quoted above, and does not contemplate concurrent melting and depositing, but rather requires depositing followed by melting. In Brown et al., it is only contemplated that the laser beam and the molten pool are used to jointly melt the feedstock. In

the present invention, the feedstock is melted by the laser beam concurrently with the feedstock being deposited, and concurrently with heating of the die surface. The die surface is heated by the laser to facilitate formation of a metallurgical bond with the melted material as it is deposited, but not for the purpose of melting the feedstock. All pending claims recite the feature that the powder material is introduced into the area or path while or simultaneous with heating of the area or path, which feature is taught against in the Brown et al. patent. Thus, the combination of Brown et al. with Baker is improper and incapable of suggesting the invention specifically claimed here, and Applicants respectfully request that the rejection be withdrawn and a Notice of Allowance issued for all pending claims.

The laser in the present invention may and preferably does include a coaxial feed, such as claimed in amended claim 21 and new claim 30. With coaxial feeding, the powder material surrounds the laser beam such that the beam's center axis is in the center of the cladding material. Thus, a coaxial feeder necessarily deposits at least a portion of the powder material within the interaction zone of the laser and die surface, which is taught against in the Brown et al. patent. With a coaxial feeder, the powder material is melted either just prior to depositing on the die surface or simultaneously with depositing on the die surface, and this claimed feature is not taught in the prior art, and is in fact taught against by Brown et al. For this additional reason, Applicant respectfully requests allowance of claims 21 and 30.

Additionally, in Brown et al., the already-deposited feedstock is passed into the interaction zone of the laser and melted surface so as to melt the feedstock into the metal pool with the volume of the feedstock being less than the volume of melted substrate material. In order to melt a significant volume of the surface, surface melting must occur first, followed by

only a very thin layer of feedstock being passed into the interaction zone in a given pass. To build a bulk structure by this method, Brown et al. "envisions the use of hundreds if not thousands of such thin layers." (Col. 4, lines 39-40.) In col. 6, lines 13-14, Brown et al. states that "the layer thickness is never greater than about 0.005 inches," which corresponds to about 0.127mm, for the production of gas turbine discs. In Example 2, col. 8, a fin was produced by depositing 0.025 inch (0.635mm) of material per pass. In the present invention, a 2mm high cutting blade can be produced in a single pass. (see specification page 15, lines 13-17) By introducing the blade material directly onto the die surface in the laser beam, concurrent melting, depositing and cladding occurs by which significant amounts of material may be clad in a single pass with high precision. As depicted in FIGS. 2-4 of the instant application, the volume of surface metal melted by the laser is only a thin layer and the volume of deposited metal is greater. This is further evidence that the method disclosed in Brown et al. is different than the method claimed in the present application. Brown et al. does not contemplate a single pass, and moreover, a single thin layer produced by Brown et al. would not be sufficient for use as a cutting blade. Claim 2 specifically claims a single laser pass, which is not obvious by the laser method and apparatus disclosed in Brown et al. in combination with the method taught by Baker et al. Thus, it is respectfully requested that the rejection of claim 2 be withdrawn for this additional reason.

Lastly, the Baker patent is directed to cutting dies, whereas the Brown et al. patent is directed to turbine blades. The patents are thus not in the same field of endeavor. One skilled in the art of cutting die manufacturing would not look to the field of gas turbine bulk articles, such as knife edge seals and discs. The references are non-analogous, and thus not properly

combinable. Moreover, Brown et al. relates to thin layers applied one on top of another without any complicated shapes or contours and intersecting regions. The Brown et al. method results in annealing of the surface and previously deposited regions due to the high volume of surface melting, prior to depositing the feedstock. As stated in Col. 5, lines 6-13, "the multiple melting is essential to the successful use of powder as a feed material." The present invention may be carried out with either a single pass or multiple passes with only modest surface melting. Annealing of the die surface may be performed with a pre-heating step, but this is not essential to the present invention, and if performed, would be a prior, separate step before cladding. The present method, with the small localized heating avoids excessive annealing of previously deposited feedstock, which is particularly beneficial with respect to intersecting portions of the cutting blades. As explained on page 5, lines 4-7 of the instant specification, annealing portions of previously-hardened intersecting blades can cause a soft spot in the blades which might reduce die life or the functional time between blade reconditioning. Thus, the significant annealing that is purposefully performed and deemed essential to the method of Brown et al. may be detrimental to blades having intersecting portions, and such significant annealing is successfully avoided by the present invention in which the cladding material is feed onto the surface while heating the surface with the laser to achieve cladding with only small localized heating. For this additional reason, the presently claimed method is not obvious in light of Baker and Brown et al., which are non-analogous references. There being no *prima facie* case of obviousness, Applicant respectfully requests that the rejections under § 103 be withdrawn, and a Notice of Allowance issued for all pending claims.

In addition to the remarks presented above, Applicant refers the Examiner to the previously submitted customer accolades and declarations from Mr. Gregg Harrison, Mr. Graham Bell, and Mr. Paul Madill, which were submitted as secondary evidence for the purpose of traversing the obviousness rejection. The evidence submitted constitutes strong rebuttable evidence of the non-obviousness of the present invention. However, the evidence submitted was not commented upon in the succeeding actions of August 17, 2001 and November 6, 2001, and Applicant can therefore only conclude that the evidence was not considered by the Examiner. MPEP § 716.01 states: "Evidence traversing rejections must be considered by the Examiner whenever present. All entered affidavits, declarations, and other evidence traversing rejections are acknowledged and commented upon by the Examiner in the next succeeding action." While the prior rejection under § 103 was withdrawn, the new rejection is also under § 103 and the evidence is equally applicable as rebuttal evidence for the new rejection. Thus, Applicant believes that the sufficiency of the evidence should have been considered and commented upon. Mr. Harrison and Mr. Bell both discussed the increased die life that has been experienced in their plants through use of the cutting dies of the present invention. Both customers stated that they have experience longer die life than with any other cutting die currently available. The declaration of Mr. Madill sets forth the nexus between the evidence of commercial success and the claimed invention, and therefore Applicant believes the evidence submitted is of probative value in the determination of non-obviousness, and should accordingly be considered. Given the above remarks as to the improperness of the *prima facie* case of obviousness, in combination with the secondary evidence of non-obviousness previously submitted, Applicant believes the claims of the present invention are entitled to Notice of Allowability.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made." Also attached hereto is a clean copy of all claims now pending in this application.

In view of the foregoing amendments to the claims and remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully request allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicants are of the opinion that no additional fee is due as a result of this amendment. If any additional charges or credits are necessary to complete this communication, please apply them to deposit account no. 23-3000.

Respectfully submitted,

WOOD, HERRON & EVANS, L.L.P.

By: Kristi L. Davidson
Kristi L. Davidson
Reg. No. 44,643

2700 Carew Tower
441 Vine Street
Cincinnati, OH 45202
(513) 241-2324 (voice)
(513) 421-7269 (facsimile)

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification

The paragraph beginning on page 11, line 9 is amended as follows:

--Turning now to Fig. 2 there is illustrated a part of the process of the invention. The laser beam 10 is scanned along the die surface 13A, so as to melt or "puddle" an area 17 in the surface 13A, along a path corresponding to the desired die blade pattern. Upon such melting or puddling, the powder 16A is fed into the area being clad by the laser so that in one pass along the surface 13A, as illustrated in Fig. 13, a die blade of half ellipse cross-sectional dimension is formed. <u>To state another way, powder 16A is fed into the path while heating the path with the laser beam 10.</u> The material of the die body 13 is selected to conform to the desired parameters in the die body for toughness. Ordinary, medium carbon plain steels or medium carbon low alloy steels such as 1045 or 4150 steel, for example, may be used.--

In the Claims

1. (Twice Amended) A method of forming a cutting die including a die body and an integral blade extending outwardly from a surface of said die body, the method comprising the steps of:

cladding a blade material onto an area of said die body surface by heating said area with a laser, introducing said blade material into the heated area <u>while heating said area</u>, and building a blade of said blade material outwardly from said surface, wherein said blade material is compositionally different and of greater hardness than a base material forming said die body surface; and

shaping the cladded blade.

2. (Twice Amended) A method as in claim 1 wherein said cladding step includes:

heating said area of said die body surface; and

introducing said blade material into the heated area while heating said area and building said blade of said blade material outwardly from said surface in a single pass of said laser.

3. (Twice Amended) A method as in claim 1 wherein the die body surface is cylindrical and including heating said area with said laser and introducing said blade material into the heated area while heating said area to completely build said blade on said cylindrical die body surface.

4. (Twice Amended) A method as in claim 1 including introducing cladding powder comprising a carbide into the heated area while heating said area for building said blade.

17. (Amended) A process for forming a cutting die comprising the steps of:

cladding a blade material onto a die surface of a material different than said blade material to form a blade extending outwardly from said surface, said cladding step including the steps of heating an area of said die surface, and introducing blade material into the heated area while heating said area and building a blade of said different blade material outwardly from said surface; and

shaping the cladded blade.

18. (Amended) A process for forming a cutting die comprising the steps of:

cladding a blade material onto a die surface to form a blade extending outwardly from said surface, said cladding step including the steps of heating an area of said die surface, and introducing blade material into the heated area while heating said area in at least two layers and building a blade of said material outwardly from said surface; and

shaping the cladded blade.

20. (Twice Amended) A method of forming a cutting die including a die body and an integral blade extending outwardly from a surface of said die body, the method comprising the steps of:

cladding a blade material onto an area of said die body surface by heating said area with a laser, and by depositing said blade material into the heated area while heating said area in multiple successive layers to form a blade extending outwardly from said surface, wherein said blade material is compositionally different and of greater hardness than a base material forming said die body surface and wherein said blade has a hardness equivalent to the final desired hardness of said blade; and

after said cladding step, shaping the cladded blade.

21. (Twice Amended) A method of forming a cutting die comprising the steps of:

depositing a carbide-containing blade material in multiple successive layers onto a cylindrical die surface by laser cladding with a material feeder coaxial with a laser beam to form a cladded blade extending outwardly from said surface, wherein said blade material is

compositionally different and of greater hardness than a base material forming said die surface; and

after said depositing step, shaping the cladded blade.

22. (Twice Amended) A method of forming a cutting die comprising the steps of:

heating an area of a cylindrical die surface in a path corresponding to a desired blade pattern including intersecting blades;

depositing a layer of blade material into said path while heating said area by laser cladding, wherein said blade material is compositionally different and of greater hardness than a base material forming said die surface;

repeating the step of depositing blade material onto a preceding layer of blade material until a blade of desired thickness is formed extending outwardly from said surface in said pattern; and

after said blade of desired thickness is formed, shaping the blade.

24. (Twice Amended) A method as in claim 22 including heating said area with said laser and introducing a carbide-containing blade material into the heated area while heating said area and building a blade having a hardness equivalent to the final desired hardness of said blade.

Cancel claim 28.

30. (New) The method as in claim 1 wherein said introducing step includes feeding said blade material by a feeder coaxial with a beam of said laser to heat said blade material while heating said area.

31. (New) The method as in claim 1 wherein said die body is cylindrical, the method including rotating said die body to provide one component of relative motion between said die body and said laser.